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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/583,841	06/22/2006	Kazunori Yamamoto	06421/LH	6328

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EXAMINER	
LEGESSE, HENOK D	

ART UNIT	PAPER NUMBER
2861	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/583,841	YAMAMOTO ET AL.	
	Examiner	Art Unit	
	HENOK LEGESSE	2861	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 July 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) *2,5,6 and 8* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3,4,7 and 9-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 07/09/2008 has been entered.

Claim Rejections – 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 1,3,4,7, and 9-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hotomi (US 5,477,249) in view of Anderson et al (US 6,017,112) and Morikoshi et al (US 6,382,754).

Regarding claim 1, Hotomi teaches a liquid ejection apparatus (an image forming apparatus, fig.1) comprising:

a liquid ejection head (1, figs.1-3) having a nozzle (15).

an ejection voltage supply (20 which constitute elements 9, 17, 18, and 19) to apply an ejection voltage to a solution (6) inside the nozzle (15) so as to charge the solution (col.4, lines 1-14, 55-66), the ejection voltage supply (20) including an electrode (9) which contacts with the solution (6) to charge the solution (6) (see figs.1-3, and col.2, lines 35-37, col.4, lines 7-9,59-61);

a convex meniscus generator (14 which constitute elements 9, 10, 11, and 12) to cause the solution (6) inside the nozzle (15) to rise from the nozzle (15) in a convex shape (meniscus "Im" in fig.2) (col.3, lines 46-58, col.4, lines 24-29); and

an operation controller (13, fig.1) to control application of a drive voltage to drive the convex meniscus generator (14) and application of the ejection voltage by the ejection voltage supply (20) so that the drive voltage to the convex meniscus generator (14) is applied in timing overlapped with the application of a pulse voltage as the ejection voltage by the ejection voltage supply (20) ("both vibrational and electrostatic

energy are required to be applied at the same time for the ink to jet" , see col.4, lines 47-55).

Hotomi further teaches a nozzle hole having a diameter of about 20μm to 200μm (col.3, line 61). Hotomi further teaches an operation controller (13, fig.1) that controls the application of voltage to the solution (6) inside the nozzle (15) so as to charge the solution and eject droplets ("Id", fig.3) of solution (6) on to a substrate (16) (col.4, lines 1-14, 55-66).

However, Hotomi fails to expressly teach a nozzle with an inner diameter of at most 15μm. Hotomi further fails to expressly teach the operation controller controls the application of a voltage having reversed polarity to the ejection voltage to be applied by the electrode to the solution inside the nozzle just before or just after the ejection voltage is applied to the solution inside the nozzle.

From the same endeavor Anderson et al teaches a nozzle with an inner diameter of at most 15μm (col.3, lines 16-26).

From the same endeavor Morikoshi et al teaches controller (figs.2, 3, 19, 23) that controls the application of a voltage with reversed polarity to the ejection voltage just before or just after the ejection voltage is applied by an electrode to the ejection actuator (9) (see figs.5 (e), 6, 24(a), col.9, line 42- col.10, line 7, col. 17, lines 47-63) in order to effectively attenuate the kinetic energy of the meniscus and to hold the meniscus at apposition suitable for jetting out the next droplet to provide a stable print output (abstract, figs.5, 6, 24(a)).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made; to have formed the diameter of the nozzles of Hotomi to be at most 15μm as taught by Anderson et al, and to configure the controller of Hotomi such that the controller controls application of voltage with reversed polarity to the ejection voltage just before or just after the ejection voltage is applied to the ejection actuator of Hotomi based on the teachings of Morikoshi et al. The motivation being in order to able the liquid ejecting head eject smaller ink droplets improving the resolution of the ejecting head thereby the quality of the image formed, and to effectively attenuate the kinetic energy of the meniscus and to hold the meniscus at apposition suitable for jetting out the next droplet to provide a stable print output (abstract of Morikoshi et al).

Regarding claim 3, Hotomi further teaches the operation controller (13, fig.1) applies the drive voltage to the convex meniscus generator (14) in advance, and also in timing overlapped with the application of the ejection voltage by the ejection voltage supply (20) (col.4, lines 38-55).

Regarding claims 4 and 7, Hotomi further teaches a liquid ejection head includes a plurality of nozzles each of which has the convex meniscus generator (see fig.14-16, and fig.18-19 shows the sectional views and parts of multi-nozzle head).

Regarding claim 9, Anderson et al further teaches wherein the inner diameter of the nozzle is between 0.2 μm and 8 μm (col.3, lines 16-26).

Regarding claim 10, Hotomi as modified by Anderson et al and Morikoshi et al above teaches substantially the claimed invention, Hotomi teaches a nozzle having diameter of about 20 μm to 200μm (col.3, line 61), and Anderson et al teaches a nozzle having diameter of 5 μm to 29 μm (col.3, lines 16-26).

Hotomi as modified by Anderson et al and Morikoshi et al fails to explicitly teach that the inner diameter of the nozzle is between 0.2 μm and 4 μm.

However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have formed the diameter of the nozzles to be between 0.2 μm and 4 μm in order to eject even smaller volume of droplets, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable range involves only routine skill in the art. In re Aller, 105 USPQ 233.

Regarding claims 11 and 12, Hotomi further teaches an opposing electrode (17 in figs.1-4) having an opposing surface which faces a top portion of the nozzle (15) and which supports a substrate (16).

Regarding claim 13, Hotomi teaches in figures 1-4 wherein the opposing electrode (17) is provided to face the top portions of a nozzle (15). However, the single nozzle shown in figs.1-4 is for illustration purpose and Hotomi teaches liquid ejection apparatus having a plurality of nozzles to print on media substrate 16 (fig.5,14-16, and

fig.18-19 shows the sectional views and parts of multi-nozzle head). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to recognize that the opposing electrode which supports media substrate 16 is provided in common for the plurality of nozzles.

Regarding claim 14, Hotomi further teaches wherein the ejection voltage supply (20 which constitute elements 9, 17, 18, and 19) is provided in common for the plurality of nozzles (see fig.5,14-16, and fig.18-19 shows the sectional views and parts of multi-nozzle head and also see the rejection of claim 13 above) so as to apply the ejection voltage to the solution (6) inside each of the plurality of nozzles (15).

Regarding claim 15, Hotomi teaches as modified by Anderson et al and Morikoshi et al further teaches the liquid ejection apparatus (figs 1-4 of Hotomi) is provided in an ink jet printer such as shown in fig.1 of Anderson et al.

Regarding claim 16, Hotomi further teaches wherein the inner diameter of the nozzle (512 in fig.17) is uniform through a length of the nozzle (512) (Note also the use of different shaped nozzles is well known in the art).

Regarding claim 17, Hotomi further teaches wherein the inner diameter of the nozzle (15 in figs.1-4, 512 in figs.13,16) is tapered (col.3 line 64, col.8 line 38).

Regarding claim 18, Hotomi further teaches wherein the inner diameter of the nozzle (15 in figs.1-3, 512 in figs.13,16) is larger at a solution-chamber (5 in figs.1-3, 513 in figs.13,16) side of the nozzle (15,512) and gradually decreases toward an ejection-opening side of the nozzle (15,512).

Regarding claim 19, Hotomi further teaches wherein the nozzle (15 in figs.1-3, 512 in figs.13,16) has a substantially conical shape.

Regarding claim 20, Hotomi further teaches wherein the nozzle (15 in figs.1-3) has a height of approximately 100 μm (see col.3, lines 59-60, the thickness of nozzle plate 4 is about 25 μm to 1mm= 1000 μm).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to HENOK LEGESSE whose telephone number is (571)270-1615. The examiner can normally be reached on Mon.- Fri. Between. 8:00 AM-6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, MATTHEW LUU can be reached on (571)272-7663. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/LUU MATTHEW/
Supervisory Patent Examiner, Art Unit 2861

H.L.
09/04/2008